

to give us more than a general idea as to the course of reactions. At the same time, it is by no means a subject which can be dismissed as being useless, because a very great deal of help may at times be obtained by the study of thermochemical data. For example, in manufacturing operations, it is of the first importance to know heats of combustion, because the number of calories required to decompose a substance is of course a guide to the manufacturer in connection with the energy required in a given process.

Quite recently Prof. J. W. Richards contributed a very useful and interesting series of papers in an American technical journal upon the thermochemistry of metallurgical processes. Furthermore, the subject is of great importance to the electrochemist, who is able to determine the voltage necessary to be employed in an electrolytic process if he knows the heats of combination of the compound. Or we might take another example. In aluminothermics it is owing to the very high heat of formation of aluminium oxide that such an enormous amount of heat is given out when aluminium reacts with certain metallic oxides, and consequently one can tell beforehand whether a given oxide will be readily reduced by means of aluminium or not.

Of all the workers in the field of thermochemistry none has done such thorough, careful, and pioneering experimental work as Julius Thomsen, and it was a happy idea of Sir William Ramsay to include a translation of Thomsen's Dutch work in the well-known text-books on physical chemistry which are now finding such an important place in the chemical literature of the country; and we may say at once that Miss Burke has done her part of the work extremely well. As she states in the preface, it has been necessary at times, owing to the advance in other branches of physical chemistry, slightly to alter the reading of certain sentences; for example, taking her own illustration, where Thomsen has used the expression "Neutralisation is regarded as a union of acid and base, with formation of water," Miss Burke has changed this to "Neutralisation is regarded as a union of acid hydrogen and basic hydroxyl to form water." Undoubtedly some chemists will take exception to such an alteration, and will say it is pedantic and unnecessary, particularly those who are not attached to the ionic theory, and, after all, there are a goodly number who consider there are many difficulties which require to be cleared up before the ionic hypothesis can be considered fundamental.

The first portion, the introduction, introduces the subject with an explanation of experimental calorimetric methods, the apparatus being described and illustrated, and the methods of using it fully gone into. Chapter i. deals with the absorption of gases and the heat produced when they, liquids or solids are dissolved in water, and a number of tables are given, with the thermochemical data. The next chapter deals with the rather complicated question of heat of hydration; the methods of calculation for obtaining the heat formation of different compounds, provided the heat formation of certain substances is

known, are carefully set out throughout the pages. The book not only deals with inorganic compounds, but also with a very large number of organic substances, the tables in chapter xii. being exceedingly full. An interesting part of this chapter is that in which the heat formation of isomeric compounds is given. Thus the difference of heat formation of propyl and isopropyl alcohol is 5.3 cal., that between isobutyl alcohol and trimethyl carbinol being 17.15 cal.

In fact, the book deals with Thomsen's work, and will undoubtedly be found extremely useful to any investigator who wishes to study this branch of the subject, and as a book of reference to be kept in all chemical libraries, though hardly, we think, for general reading, as it is rather too full for this purpose.

F. M. P.

#### MATHEMATICAL TEXT-BOOKS.

- (1) *The Elements of the Geometry of the Conic.* By Prof. G. H. Bryan, F.R.S., and R. H. Pinkerton. Pp. xi+270. (London: J. M. Dent and Co., 1907.) Price 3s. 6d.
- (2) *Geometry, Theoretical and Practical.* By W. P. Workman and A. G. Cracknell. Part ii. Pp. ix+(330-335). (London: W. B. Clive, 1908.) Price 2s.
- (3) *Practical Integration for the Use of Engineers, &c.* By A. S. Percival. Pp. vi+86. (London: Macmillan and Co., Ltd., 1907.) Price 2s. 6d. net.
- (4) *Integration by Trigonometric and Imaginary Substitution.* By C. O. Gunther. Pp. vi+79. (London: A. Constable and Co., Ltd., 1907.) Price 5s. net.
- (5) *A Course in Mathematics for Students of Engineering and Applied Science.* By F. S. Woods and F. H. Bailey. Vol. i., Algebraic Equations, Functions of one Variable, Analytic Geometry, Differential Calculus. Pp. xii+385. (Boston, New York, Chicago, London: Ginn and Co., n.d.) Price 10s. 6d.

(1) **T**HIS is an attractive little book on geometrical conics. The argument is very clear, and presents the subject to a beginner in the simplest possible manner. The difficulty in writing a text-book of this sort lies in the fact that many properties of conics are far more easily treated by analytical than geometrical methods. The authors have met this difficulty by putting first those results which lend themselves more readily to geometrical proofs; other theorems are left until later on, and then the methods, if not the nomenclature, are analytical. A reasonably large number of examples is given, which are nearly all of a graphical or numerical nature. This is a pleasing innovation, and theoretical examples can be supplied by the teacher, if required, from almost any other text-book. A property of the parabola is discussed at the same time as the corresponding property of a central conic; much might be said both for and against this course. Many of the proofs are ingenious; the construction of the hyperbola by means of string and pins alone is worth noticing. A chapter is given in which are discussed those properties of the cycloid, catenary, &c., which can be proved without the aid of the calculus.

(2) This book covers the ground of Euclid ii., iii. 35 to 37, iv., and vi., together with the properties of harmonic (but not of anharmonic) ranges, the nine-point circle, the radical axis, poles and polars, inverse figures, &c. The text is on the whole more theoretical than practical; the examples are divided into theoretical riders, practical constructions, and calculations, a good and sufficient collection of each being given. The book contains rather more than the average student will require; the authors asterisk some of the less necessary sections, and probably the teacher will advise the omission of others also. The properties of rectangles are developed from the geometrical standpoint; algebraic methods are, however, also given. In the theory of proportion only commensurable quantities are dealt with at first, the extension to incommensurables being given in the last chapter. The book is sound and sensible throughout, and deserves to hold its own easily in the severe competition which text-books on elementary geometry have to face at present.

(3) The author starts by defining integration as the inverse of differentiation, and then shows how to find the indefinite integrals of all the usual standard types. This part of the book may be quite useful, but the latter portion is not so satisfactory. The author has attempted too much for the space at his disposal, and sacrifices in places not only soundness but intelligibility also. Definite integrals are introduced without any adequate explanation, and the connection between definite and indefinite integrals is obscure. It is almost impossible to make applications of the calculus to geometry clear without a single diagram or without proving that a definite integral may be considered as the limit of a sum; this is, however, what the author attempts. In fact, the argument is too condensed to be followed by the type of student for whom the book is written; for instance, such a step as " $-d\theta/dt = a\theta$ ,  $\therefore d\theta/\theta = -adt$ " is sure to give trouble if unexplained.

Minor errors are the statement of the "test-ratio" rule on p. 36, and misprints at the bottom of pp. 42, 43. A book which aims at being "practical" should not calculate the temperature of a cup of tea to four places of decimals.

(4) This book is very short; for the margins and print are large, while twenty-six of its seventy-nine pages are occupied by a somewhat superfluous introduction, and fifteen by solutions of examples. The remainder is devoted to the indefinite integral of  $\cos^m x \sin^n x$  ( $m$  and  $n$  integral) without the aid of reduction formulæ, and to the integral of expressions involving  $\sqrt{a^2 - x^2}$ ,  $\sqrt{a^2 + x^2}$ , &c. This latter part is done better in other books; for surely in integrating  $\sqrt{a^2 + x^2}$  the substitution  $x = a \sinh \theta$  is preferable to  $x = 2a \sin \theta$ .

(5) This book is intended to cover the mathematics learnt in the first year of a two years' course at an engineering school. The authors disregard the traditional division of mathematics into distinct subjects, and introduce the principles of each subject as needed. By thus developing algebra, analysis, and calculus

side by side the student has his interest stimulated, realises the interdependence of different parts of mathematics, and learns the art of choosing the best method of attacking any given problem. Against this must be set the fact that the conventional division of mathematical study has the great advantage of helping the student to systematise his knowledge. If once we admit the principle of no division, we could hardly wish for a better book. The subjects are very skilfully coordinated; the treatment throughout is sound and mathematical without ceasing to be interesting or "practical." The examples are useful and very numerous, and answers are given. In this first year's course is covered a good deal of the more elementary parts of the theory of equations, determinants, graphs, analytical geometry as far as the general equation of the second degree, and differential calculus, including curvature and critical values of functions, but not asymptotes. Conics, especially geometrical conics, are treated less fully than usual; their place is partly taken by other interesting curves. Excellent and interesting though the book is, it makes heavy demands on the reader's attention, and would probably require considerable ability on his part if it is to be mastered in one year.

#### OUR BOOK SHELF.

*Nephilim*. By William J. H. Bohannon. Pp. 236. (New York: Reeve A. Silk, 1908.) Price 1.50 dollars.

"This book is written," so we are told, "to show the error of 'science,' and to point out the truth of statement of the Bible concerning physical phenomena."

It certainly does show the error of "science," as understood or misunderstood by the author of the book. The following extracts are given merely as examples of the style in which the book is written:—

"The more the thermic dominates in structural composition of a body, the more penetrable it is to the magnetic entities of the field of another and the less to the thermic of that field."

"The earth's thermic entities of field, emitted from her equatorial region, her southward geographical pole being toward the sun, were taken outward from him, under the action of the entities of his field, her inseparable thermic entities of field enveloping the separable of her northern regions."

As a further example, we are informed by way of correction that "*Nephilim*," p. 154, fourth sentence, should read: "The planet Jupiter, on the other hand, had three tails, two visible to human eye, passing outward from the poles of the planet and from the sun; the other one magnetic and invisible, but vastly greater than the visible, passing from the equator of the planet toward the sun."

Some of the chapters suggest a kind of vortex theory, while others profess to deal with the theory of the tides. The author of "*Nephilim*" would have stood a better chance of recognition if he had made a careful study of the whole existing literature on one or other of these two subjects. The mere quotation of extracts from articles in popular encyclopædias, the contributors of which were probably limited to 1000 or 2000 words, is a very small step in that direction. Such short articles were never intended to give a complete explanation of all the difficulties which have been studied in connection with these theories;